REMOTE CONTROL OPTION
AT14920

INTRODUCTION

The Remote Control Assembly may be fitted as an optional extra to the FR5000 series Base Stations. It enables the Base Station to be controlled by a M80 series Controller using AC signalling over a 2/4 wire 600Ω line.
The Remote Control Assembly is located in the Control Module where it is mounted on a PCB carrier plate, the assembly comprises a motherboard, which provides an interface with the Base Station, and a Facilities PCB. The AC signalling system uses a 2970Hz continuous tone to key the transmitter and a 112ms burst of FSK data which contains commands for activating the squelch defeat, line intercom and talkthrough facilities.

SUMMARY OF DATA

Line Connections

Type	2 or 4 wire
Line Specification	minimum specification to British Telecom schedule A line or equivalent.

Line audio

Audio Level	2 wire -18dBm 4 wire -14dBm
Frequency Response	300Hz to 3,4kHz±3dB relative to level at 1kHz, or as limited by British Telecom line.
Control Frequencies	2970Hz ±5Hz (key tone) 2295Hz ±5Hz (FSK low tone) 2505Hz ±5Hz (FSK high tone)
Key Tone Level	at least 18dB below peak speech line audio level and greater than -42dBm.
FSK Level	at least 8dB below peak speech line audio level and greater than -40dBm.

Control Functions

Transmission rate	300 baud
Preamble tone length	125ms±25ms
Start bit	logic 0
Stop bit	logic 1
Parity	odd
Bit time	36,6ms±3%
Inter word time	less than 15ms

INSTALLATION

Installation Items

Description	Part No	Remarks
Scr st tap pozi No4 x 8mm	QJ08241/X	2/M80 signalling assembly - Control Module

Note: Refer to Fig.1 throughout this installation procedure.

(1) Release the securing fasteners and withdraw the Control Module on its runners to gain access to the Control Logic PCB.

(2) Connect the lead assembly AT70246 to PLC on the Interface PCB and, routeing the leads around the back of the PCB carrier, pass the free end of the lead assembly through the top rearmost hole in the Control Plate.

(3) Taking care not to trap the lead assembly, hook the M80 signalling assembly mounting plate round the rear end of the control plate and secure the upper and lower lugs to the Control Unit front panel with the two screws provided.

> **CAUTION**
> **Before the following connections are made it is important to ensure LK2 of AT04872/- is set B-C, this is to prevent contention between the outputs of IC1, IC2 of AT04872/- and the RCM control outputs.**

(4) Referring to the STANDARD LINKING FUNCTIONS connect the free end of lead assembly AT70246 to P21 and the appropriate pins of LK1 on the Control Logic PCB to provide the functions required.

(5) Connect cable assembly AT70245 from PLB on the Interface assembly to PLC on the Control Logic PCB.

(6) Connect the 25-way ribbon cable from the backplane to the Interface assembly.

(7) Push the Control Module into the shelf assembly and tighten the securing fasteners.

STANDARD LINKING FUNCTIONS

Note:
(i) The following table defines the interconnection between the Interface PCB and the Base Station Control Module Logic PCB necessary to achieve a number of standard functions. Due to the flexible design of the Base Station it is impractical to produce a definitive list of all the potentially useful linking combinations that could be made.
(ii) Leads not used should be parked on the appropriate 'a' position of LK1 on Control Logic PCB AT29023.
(iii) The interconnecting leads are colour coded, using the resistor convention, with respect to the pin numbers on AT29074.

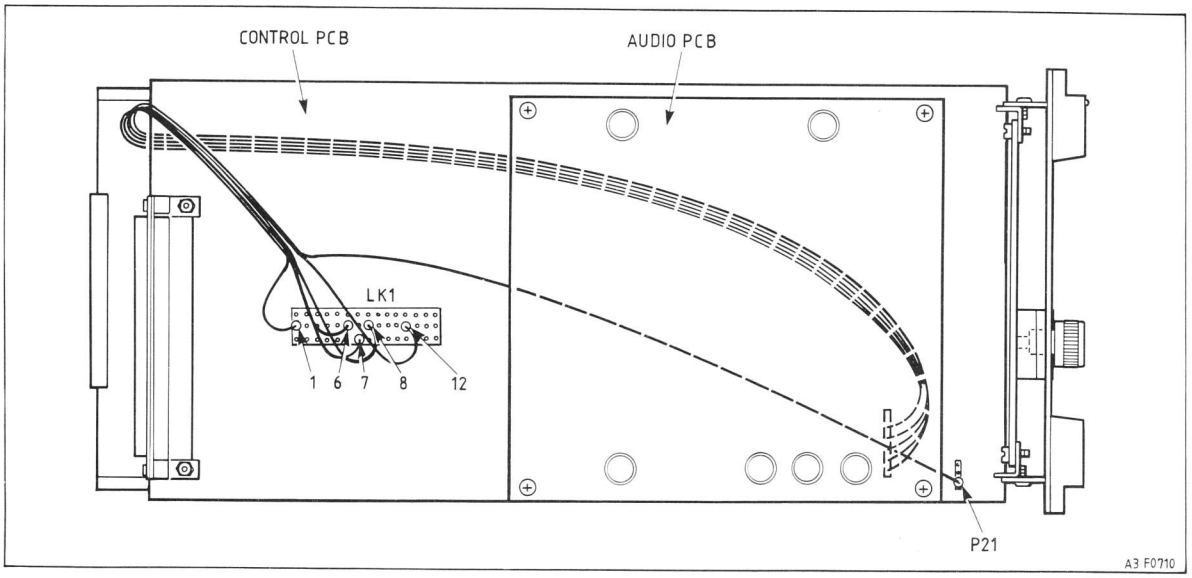

Fig. 2 Connections

Function	Interconnection		Remarks
	Interface PCB AT29074	Logic PCB AT29023	
Key Tone I/P to RCM	PLC pin 1 (Brown lead)	P21	Required when T/T function enabled and is fitted as standard. Used to prevent Line Fail T/T timeout when Tx is keyed.
Intercom enable Intercom disable	PLC pin 2 PLC pin 2 (Red lead)	LK1 pin 6b LK1 pin 6a	
Line data enable Supervisory tone signal enable Supervisory tone signal disable	PLC pin 3 PLC pin 3 (Orange lead)	LK1 pin 1b LK1 pin 1a	Enables supervisory tone to line, when deselected RV4 of AT28793 should be adjusted to set minimum audio from FSK tone generator.
Talkthrough enable Talkthrough disable	PLC pin 4 PLC pin 4 (Yellow lead)	LK1 pin 8b LK1 pin 8a	
Squelch defeat enable Squelch defeat disable	PLC pin 5 PLC pin 5 (Green lead)	LK1 pin 12b LK1 pin 12a	
Base Station Select required Base Station Select not required	PLC pin 6 PLC pin 6 (Blue lead)	LK1 pin 6c LK1 pin 7a	This function is exclusive with the channel change option. PLC pin 6 may also be used to connect M80 special function output to any control function on LK1 of AT04872/- e.g. disable CTCSS encode.

DETAILED DESCRIPTION

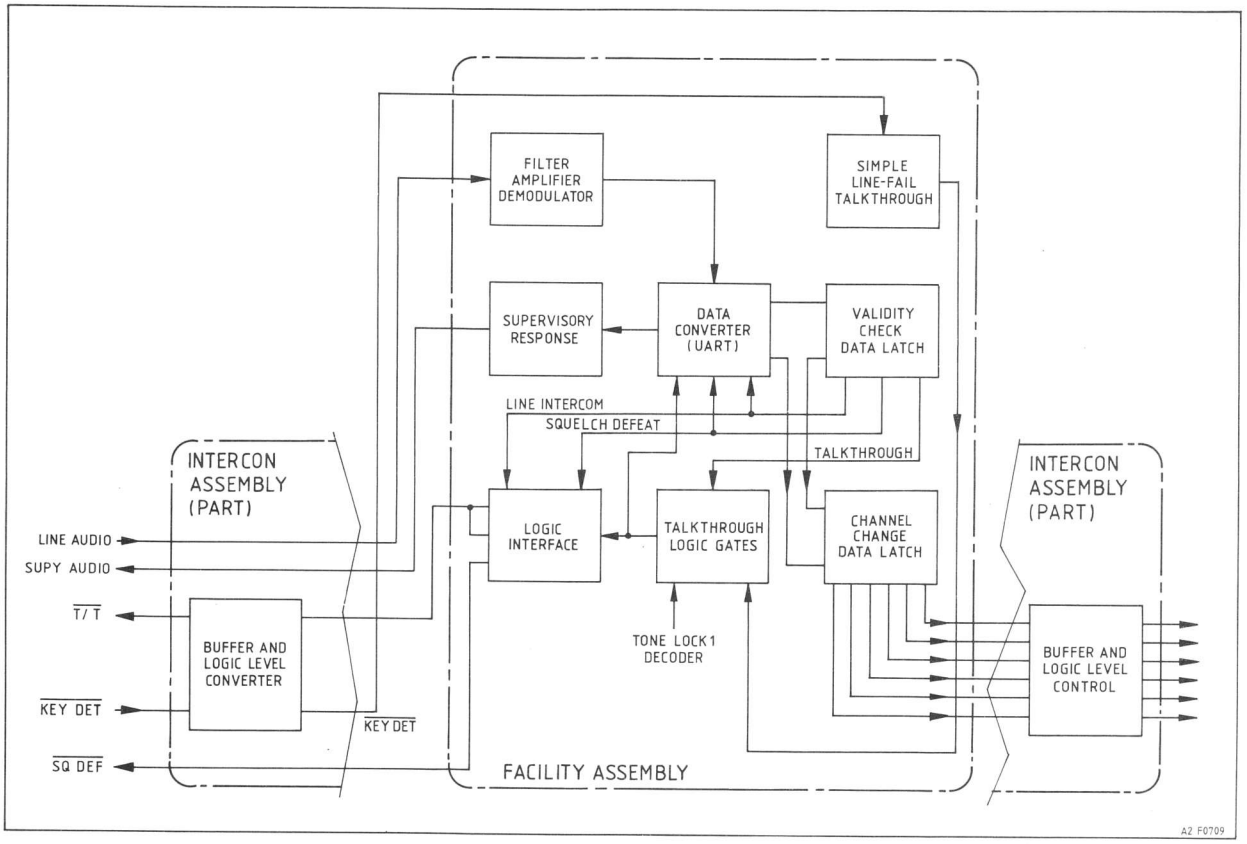

Fig. 3 Block Diagram

Summary

Interface PCB AT29074

The Interface PCB provides matching between the Facility PCB, Base Station and M80 Control Unit, also the 10V DC supply for the Facility PCB. An 18V DC input from the Base Station PSU is fed via PLA pin 15 to voltage regulator IC1, the output of which is the 10V DC supply for the Interface and Facility PCB's.

IC2, a Quad Comparator, acts as a buffer and logic level converter for the FSK DATA VALID, T/T, LINE I/C and KEY DETECT facilities. IC3, IC4 and IC5 control the Channel Change and Logic Function outputs as set by LK1, LK2 and LK3.

Links LK1 and LK2 control the logic inversion function of quad exclusive OR gates IC3 and IC4. LK1 enables the logic output of IC5 channel lines C1 to C6 to be inverted thereby allowing the channel change output to be linked via LK3 to provide base station site selection when channel change is not required. LK2 enables the logic output of IC5 'special function 4' and 'free function pin' lines to be inverted. Link LK3 provides access to the eight output signals from IC5 (six channel change, 'special function 4' and 'free function pin') via a current limiting resistor, R15, to a common connection at PLC pin 6 which may be used to drive a Base Station control module, this allows special functions e.g. 'RF power control' to be selected on the basis of channel selected.

Facilities PCB AT28793/04

The purpose of the Facilities PCB is to decode commands originating from the M80 series Controller. These commands are in the form of FSK bursts and the assembly converts them into logic outputs corresponding to the base station facility requested by each command.

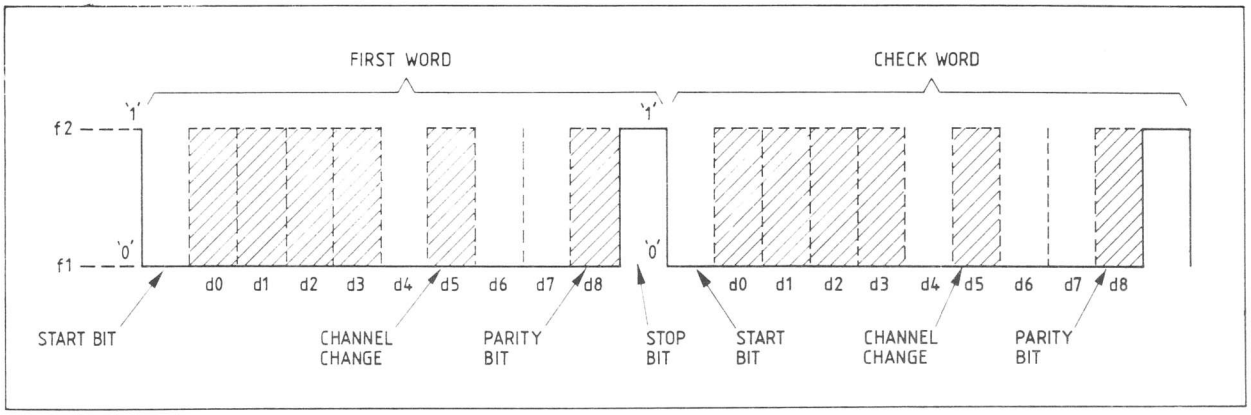

Fig. 4 M80 Signalling Format

Fig. 4 shows the format of an M80 FSK signalling burst. It consists of two eleven bit words, the second being a repeat of the first to provide extra security against noise and speech being decoded as FSK commands. Each word begins with a start bit, followed by the eight data bits, then a parity bit and finally a stop bit. The first four bits provide individual control for the base station facilities, provided the four most significant bits are 'low'. The sixth bit is used as a flag to indicate that the first four bits are to be interpreted as a channel change information, bits 4,5 and 7 being low.

Demodulation and Data Conversion

Line audio comes into the Facilities PCB on SKG pin 7 and is fed through a bandpass filter (IC1, IC2) and unity gain buffer amplifier IC3(b). After attenuation of the audio signal by R12 and R13, the FSK information present in the audio is fed into the demodulator IC4 and the demodulated output appears as a digital pulse train at pin 7. This output is gated with the lock output from IC4 pin 6 to provide a valid demodulated signal. NAND gate IC20(c) will then allow the data through to IC14, the Universal Asynchronous Receiver/Transmitter (UART), via IC8(c). Movement of data from IC20(c) is prevented by the OR gate IC8(c) while supervisory information is being sent.

The data is fed into IC14 on the 'Serial Data In' terminal, pin 20. IC14 converts this serial form data into parallel form by loading it into it's receiver holding register and then presenting the data outputs simultaneously on the receiver bus IC14 pins 5-12. When this has occurred, a logic 'high' appears on the Data Available Terminal pin 19 to flag the arrival of each word. Half a UART clock period later, IC15(b) applies a 'low' to IC14 pin 18 (Data Available Reset) resetting pin 19 to a 'low'. This enables IC14 to receive the next data pulse train from IC4.

Word Validation

IC15(a), IC16, IC18 and IC21 serve to check the validity of FSK information received by the Remote Control Module. A correct FSK signal burst should consist of two identical eight bit words. Each word is checked individually and then the lower nibble of the two are compared before their information is accepted. Referring to the receiver bus terminals of IC14, the frame error (FE) and parity error (PE) outputs indicate when the received word is the wrong length or when an odd number of bits have been corrupted in transmission.

For a correct data word, IC14 pins 5,6,8,13 and 14 of will be 'low'. When these outputs are accompanied by the data reset from IC15(b), there will be a pulsed 'high' output from the NOR gate IC21. This will be inverted to 'low' at the output of IC19(a). The result of this arrangement is that on arrival of the first data word, the output from IC15(a) pin 1 is switched to a 'low'. This 'low' together with the pulsed 'low' output from IC19(a) enables IC16(a) to latch the first four bits of the data word coming in from the DO-D3 terminals of IC14. On the arrival of the second data word, the pulsed 'high' output from IC21 will result in a reversal of the outputs from IC15(a) pins 1 and 2. In this state the latch IC16 will be disabled.

IC18 will then have the first data word from latch IC16 presented to it on pins 1,9,11 and 14 and the second data word, from IC14, presented on pins 2,7,10 and 15. Comparison of both words by IC18 will be enabled while there is a pulsed 'high' from IC21. If both words are the same, the outputs from IC18 pins 12 and 13 will be low and storing of the new information in the output latch IC17 will be enabled.

Facility Outputs

The valid data necessary for providing facility control in the base station appears as a 'high' on IC17 pins 4,5 and 6. Output pin 3 is a spare. Each output is then fed to the Interface PCB via a logic interface circuit comprising IC20(a),IC23 and TR1.

These outputs are routed as follows:-

(i) The talkthrough output from IC17 pin 6 is fed through OR gates IC7(a) and IC8(a), a 5V to 10V logic level converter IC23(d) and the NAND gate IC20(a). Gates IC8(a) and IC10(a) are to ensure that the mobile controlled talkthrough facility is only enabled when the Tone Lock Decoder is in receipt of the appropriate lock tone, i.e. when the receiver squelch is lifted. The talkthrough output is gated at IC7(a) with an output from the line-fail counter IC6. This allows IC6 to switch talkthrough on in the event of a line condition i.e. when the key tone is absent at SKG pin 9 of the Facilities PCB.

(ii) Squelch defeat output from pin 5 switches on TR1 and the collector current of this then operates the squelch defeat logic in the receiver. The squelch defeat control is also fed through logic level converter IC23(c) and gated with the talkthrough control at IC20(a). This ensures that the squelch defeat overrides the talkthrough.

(iii) The line intercom output from IC17 pin 4 is fed to IC23(b) which acts as a non-inverting buffer and logic level converter. This output is used in the Audio Assembly to inhibit keying of the transmitter.

Supervisory Function

IC9, IC12(a), IC13 and the associated logic gates provide a superivsory function by enabling a serial form data output from IC14, and from this producing a supervisory FSK tone burst.

To initiate this fuction, the current score of facility outputs from IC17 is transferred to the transmit bus, IC14 pins 26-29, via the select gate IC22. However, when the channel change facility occurs, IC22 will be switched to its opposite state, causing DO-D3 (pins 9-12) of the receive bus to be connected directly to DO-D3 of the transmit bus in IC14. D4, D6 and D7 of the transmit bus are strapped to logic 'low' and thus represent the check bits of the originally received word. D5 represents channel change and is also 'low', except when channel change is indicated in which case it will be 'high'.

When IC14 pin 23 is pulsed 'low', the data available on the transmit bus appears in serial form on the serial data output terminal, pin 25. This output is fed into IC9 on pin 9 where it is converted to FSK modulated data and is then routed to the Audio Assembly via SKG pin 6. The frequency of the FSK output is determined by externally connected timing resistors. Trimming potentiometers RV2 and RV3 provide a high and low frequency to the FSK output while RV4 sets the amplitude.

IC13 is a decade counter and controls the timing of FSK sends from IC9. On arrival of the first valid data word, the output of IC12(a) pin 2 will be clocked to a logic 'low' causing a reset to be applied to counter IC13 on pin 15. On arrival of the second valid word, the clocked output of IC12(a) changes its state to a logic high, and the reset is removed from IC13 allowing it to begin its count of 0-8. When IC13 reaches the count of 3 it will, by means of NAND gate IC10(a), cause a double negative-going pulse to be applied to IC14 pin 23. This results in a double send of the data word from IC14 pin 25, which is a facsimile of the originally received FSK signalling burst. The counter IC13 stops at 8 because of a reset 'high' from pin 8 to pin 13.

Channel Change

Referring to Fig.3 the binary coded channel change information is contained in the DO-D2 bits of the FSK data word. This is distinguished from facility information by the D5 bit which produces a logic 'high' on IC14 pin 7. Additionally, bits D4, D6 and D7 will produce a 'low' on pins 5,6 and 8 of IC14 and when these outputs are fed to IC25, they will be treated as valid channel change information. When this condition exists, and the output from IC18 pin 3 pulses 'high' then the output on IC25 pin 3 will also pulse 'high'. This enables the eight bit addressable latch IC24 to latch in the channel change information from IC14.

When a valid channel change word is received, the output at IC12(b) pin 13 will clock 'high'. Since this output is fed onto the transmit bus, IC14 pin 31, it will result in the supervisory signal correctly representing receipt of channel change information.

Line-Fail

The function of this is to provide an automatic switch to talkthrough if the line connection between the Remote Control Module and the M80 series Controller is broken. The counter of IC6 is reset whenever a valid data word is received and whenever keytone is detected. If neither of these events occur in a time period of 54 seconds, the counter will stop and IC6 pin 15 will go 'high'. Provided the link LK2 is in position B-D, this 'high' will be used to switch the Base Station to talkthrough.

Two alternative link positions are provided, these are:-

(i) A-D to provided continuous talkthrough

(ii) C-D to inhibit line-Fail talkthrough

Data Codes

The following is a list of the remotely controlled facilities and the data codes used for selecting them.

D7	D6	D5	D4	D3	D2	D1	D0	Normal Use
0	0	0	0	*	*	*	*	
Indicates bit per function							Function 1	Talkthrough on = 1, off = 0
						Function 2		Squelch Defeat on = 1, off = 0
					Function 3			Line Intercom on = 1, off = 0
				Function 4				Special Function Reserved
0	0	1	0	0	*	*	*	
Channel change				Binary coded channel number Null channel = 0000 i.e. no channel selected				
				0	0	0	1	Channel 1 selected
				0	0	1	0	Channel 2 selected
				0	0	1	1	Channel 3 selected
				0	1	0	0	Channel 4 selected
				0	1	0	1	Channel 5 selected
				0	1	1	0	Channel 6 selected

SETTING UP AND ALIGNMENT PROCEDURE

Note: (i) Before carrying out the following procedure ensure that the base station transmitter and receiver are correctly aligned.
(ii) For the purpose of this procedure no links need be fitted to the Interface PCB AT29074

TEST EQUIPMENT

Note: Refer to Part I, Table 3.1 for suitable types.

10 RF Signal Generator
2 AF Generator
19 SINAD Meter
22 50W, 50Ω Dummy Load
4 Digital Voltmeter
5 Oscilloscope
12 Frequency counter
- M80 Series Control Unit (wired for 2 or 4 wire line as required with facilities and channel change

TEST PROCEDURES

Linking Information

FACILITY ASSEMBLY AT28793/04

Link	Position	Function
LK1	A-B B-C	Engineering Tone On Supervisory On
LK2	B-D A-D C-D	Line Fail Talkthrough Permanent Talkthrough Inhibited Talkthrough

INTERFACE BOARD AT29074

Link	Position	Function
LK1	B-C A-B	Channel Change Logic Output Active Low Channel Change Logic Output Active High
LK2	B-C A-B	Logic Function Output Active Low Logic Function Output Active High
LK3	A B C D E F G H	Channel 1 Channel 2 Channel 3 Channel 4 Channel 5 Channel 6 Special Function Unused Open Collector Buffer

Note: (i) Set LK1 active low to select a channel, active high to select a base station.
(ii) Standard position for LK1, LK2 is B-C
(iii) Default standard for LK1, LK2 is low.

DC Supply Check

1. Switch off the base station and disconnect PLG/SKG interconnecting the RCM Facility PCB AT28793/04 and the Interface PCB AT29074.

2. Switch on the base station and check that the voltage between pin 2 of regulator IC1 and the negative plain of the Interconnecting PCB AT29074 is between 9,3 and 10,5V DC.

3. Switch off the base station and reconnect PLG/SKG.

FSK Output Level

1. Link RCM Facility PCB AT28793/04 as follows:-

   LK1 A-B Engineering Tone On
   LK2 C-D Inhibit Talkthrough

2. Ensure interconnections between Interface PCB AT29074 and Logic PCB AT29023 are as follows:-

   PLC pin 1 - P21 connected

   All other connections in the park position (pin 'a')

3. On the Logic PCB AT29023 connect a temporary shorting link between LK1 pin 1B and TP1 (ground), this opens the audio data path between the RCM Facility PCB AT28793/04 and line.

4. Connect the Audio Level Meter to SKU pins 1 and 3 (600Ω Rx) at the rear of the base station.

5. Switch on the base station.

6. Adjust RV4 on RCM Facility PCB AT28973/04 and RV14 on Control Audio PCB AT29024/01 for maximum output.

7. Adjust RV14 on Control Audio PCB AT29024/01 for an output to line of -10dBm.

8. Adjust RV4 on RCM Facility PCB AT28973/04 for an output to line of -14dBm (4 wire), -18dBm (2 wire).

9. Disconnect the Audio Level Meter from SKU pins 1 and 3, connect the Audio Frequency Counter to SKU pins 1 and 3.

Note: The controls detailed in the following procedures are factory preset; adjustments are normally only required if associated components are replaced.

10. Check tone output frequency is 2295Hz±5Hz, if necessary adjust RV3 on the RCM Facility PCB AT28793/04 to obtain this frequency.

11. Remove LK1 on the RCM Facility PCB AT28793/04.

12. Check tone output frequency is now 2505Hz±5Hz, if necessary adjust RV2 on the RCM Facility PCB AT28793/04 to obtain this frequency.

13. Refit LK1 on the RCM Facility PCB AT28793/04 in the B-C position.

14. Remove the temporary shorting link between LK1 pin 1b and TP1 on the Logic PCB AT29023, fitted at step 3.

15. Check that the FSK tone to line is muted.

16. If the Line Fail Talkthrough option is required fit LK2 B-D on the RCM Facility PCB AT28793/04.

FSK Receiver

1. Set the AF Signal Generator to -14dBm at 2,4kHz and connect to SKU pins 4 and 5 (Tx) on the rear of the base station.

2. Using the oscilloscope check that the peak voltage on TP1 of the RCM Facility PCB AT28793/04 is greater than 60mV.

3. Switch off the base station.

Functional Checks

1. Connect the M80 Series Control Unit to the 600Ω line socket SKU at the rear of the base station.

2. Connect the Thruline Wattmeter to the base station Tx Output.

3. Set the RF Signal Generator to 1mV at the frequency in use and connect to the base station Rx input.

4. Select the required Functions by removing the appropriate interconnecting leads between the Interface PCB AT29074 and the Logic PCB AT29023 from the 'park' position and connecting them to the enable position. Switch on the base station.

5. Carry out the applicable Functional Checks dependent on the linking and Options for which the base station is set up.

6. If any of the Functional checks fail, set up the FSK demodulator as follows:-
   (i) Using the oscilloscope, monitor IC20 pin 10 on the RCM Facility PCB AT28793/04
   (ii) Continually send Data Code 0000 0001 from the M80 Control Unit and adjust RV1 on the RCM Facility PCB AT28793/04 for a 1 to 1 mark space ratio for start bit and first data bit.

7. If Line Fail Talkthrough is enabled, disconnect the M80 Control Unit from the base station and check that the base station detects Line Fail within one minute and switches to Talkthrough.

Conclusion

1. Switch off base station and remove all test equipment.

2. Set links as required and reconnect all leads disconnected for the Test Procedure.

PARTS LIST

REMOTE CONTROL ASSEMBLY
AT14920

Cct Ref	Description	Part No.	Remarks
	PCB Assy RCM Facility	AT28793/04	
	PCB Assy Interface	AT29074	
	Cable assy ribbon	AT70246	To LK1, P21 Control PCB
	Cable assy ribbon	AT70247	To PLB Channel 1-6 Facilities
	Carrier Assy	AT14919	
	Pillar hexagon	BT04402	2/Carrier-Facilities PCB
	Pillar hexagon	BT04404	1/Carrier-Facilities PCB
	Scr st csk pozi M2,5 x 6mm	QJ11601/B	1/Post-carrier
	Scr st pan pozi M2,5 x 6mm	QJ11945/B	3/Facilities PCB-posts, 2/Posts-carrier
	Scr st pan pozi M3 x 6mm	QJ11901/X	4/Interface PCB-carrier

FACILITY PCB
AT28793/04

Semiconductors & IC's

IC1-3	IC Dual Op Amp 1458	FU99092
IC4	IC FSK Demod/tone decoder	FU03751
IC5	IC 4060mos	FU99121
IC6	IC 4020mos	FU99067
IC7,8	IC 4071mos	FU99093
IC9	IC Mono function gen	FU03750
IC10	IC 4011mos	FU99062
IC11	IC 4081mos	FU99097
IC12	IC 4013mos	FU99064
IC13	IC 4017mos	FU99101
IC14	IC Uart	FU09159
IC15	IC 4027mos	FU99071
IC16,17	IC 4076mos	FU99140
IC18	IC Cos/mos Mag Comparator	FU09166
IC19	IC 4093mos	FU99103
IC20	IC 4023mos	FU99069
IC21	IC 4078mos	FU99130
IC22	IC 4019mos	FU99066
IC23	IC Quad comparator	FU99120
IC24	IC 4099	FU99136
IC25	IC 4585	FU99144
TR1,2	Transistor BC547b	FV05891

Resistors

R1	4k64	±1%	0,25W	m film	PL99094
R2-4	8k25	±1%	0,25W	m film	PL99097
R5	6k81	±1%	0,25W	m film	PL99096
R6	21k5	±1%	0,25W	m film	PL99102
R7-9	8k25	±1%	0,25W	m film	PL99097
R10	6k81	±1%	0,25W	m film	PL99096
R11	38k3	±1%	0,25W	m film	PL99105
R12	3k3	±5%	0,25W	c film	PM01442
R13	2k2	±5%	0,25W	c film	PM01440
R14	150k	±5%	0,25W	c film	PM01462
R15	82k5	±1%	0,25W	m film	PL99109
R16	1m	±1%	0,25W	m film	PL51210
R17,18	100k	±1%	0,25W	m film	PL99110
R19	560k	±5%	0,25W	c film	PM01469
R20-22	22k	±5%	0,25W	c film	PM01452
R23	100k	±5%	0,25W	c film	PM01460
R24-27	56k	±5%	0,25W	c film	PM01457
R28	100k	±5%	0,25W	c film	PM01460
R29	1m	±1%	0,25w	m film	PL51210
R30	10k	±5%	0,25W	c film	PM01448
R31	100k	±5%	0,25W	c film	PM01460
R32	52k3	±1%	0,25W	m film	PL45345
R33	59k	±1%	0,25W	m film	PL45350
R34	220	±5%	0,25W	c film	PM01428
R35,36	10k	±5%	0,25W	c film	PM01448
R37	39k	±5%	0,25W	c film	PM01455
R38-40	10k	±5%	0,25W	c film	PM01448
R41	100k	±5%	0,25W	c film	PM01460
R42	100	±5%	0,25W	c film	PM01424

Cct Ref	Description	Part No.	Remarks
Resistors (Cont'd)			
R43,44	10k ±5% 0,25W c film	PM01448	
R45	100k ±5% 0,25W c film	PM01460	
R46	10k ±5% 0,25W c film	PM01448	
R47	39k ±5% 0,25W c film	PM01455	
R48,49	Not Used		
R50	10k ±5% 0,25W c film	PM01448	
R51-54	100k ±5% 0,25W c film	PM01460	
RV1	47k ±20% Pot skel lin	PL01498	
RV2/3	10k ±20% Pot skel lin	PL01478	
RV4	47k ±20% Pot skel lin	PL01498	
Capacitors			
C1	10 ±20% 63V elec	PS99445	
C2	10n ±5% pes	PQ99532	
C3,4	10n ±2,5% 63V pp	PQ99621	
C5	10n ±5% pes	PQ99532	
C6	100n ±10% 63V pes	PQ99511	
C7	4n7 ±5% 25V cerm	PN99731	
C8-10	100n ±10% 63V pes	PQ99511	
C11,12	10n ±10% 63V pes	PQ99510	
C13	470p ±5% cer	PN99886	
C14	220p ±5% cer	PN99882	
C15	33 ±20% 16V elec	PS99409	
C16	6n8 ±5% 25V cer	PN99732	
C17	1 ±20% 50V elec	PS99869	
C18	10 ±20% 63V elec	PS99445	
C19	470n ±20% 50V elec	PS99867	
C20,21	33 ±20% 16V elec	PS99409	
Miscellaneous			
	Cable ribbon 10 x 28awg	FC99200	
	Con fem skt 10 pos'n	FS99185	
PLA	Con PCB solder 10 pos'n	FP99150	
	Link connector	FC99060	
XL1	Xtal, cer resonator 307khz	FC03199	

INTERFACE PCB
AT29074

Semiconductors & IC's			
IC1	IC Volt reg 317	FU99119	
IC2	IC Quad comparator	FU99120	
IC3,4	IC 74HC86	3513 993 32027	
IC5	IC UDN2595A	FU99708	
TR1	Transistor BC337	FV05896	
D1	Diode GP BYW54	FV05892	
D2	Diode GP 1N4148	FV05808	
D3			Not Used
D4-7	Diode GP 1N4148	FV05808	
Resistors			
R1	215 ±1% 0,25W m film	PL99078	
R2	1k47 ±1% 0,25W m film	PL99088	
R3	100k ±2% 0,25W m film	PM99330	
R4,5	10k ±2% 0,25W m film	PM99306	
R6	1k ±2% 0,25W m film	PM99282	
R7-9	10k ±2% 0,25W m film	PM99306	
R10	100 ±5% 2,5W ww	PM01124	
R11-15	820 ±2% 0,25W m film	PM99280	
RN1	100k ±5% 9-pin sil	RN99531	
Capacitors			
C1	100n ±10% 63V pes	PQ99511	
C2,3	1 ±20% 50V elec	PS99869	
C4	100n ±10% 63V pes	PQ99511	
C5	10 ±20% 35V elec	PS99861	
C6	1n ±20% cer	PN99915	
C7-9	100n ±10% 63V pes	PQ99511	

Cct Ref	Description	Part No.	Remarks
Miscellaneous			
	Cable assy ribbon	AT70245	To PLC on Control PCB
	Connector PCB solder 16 pos'n	FP99151	
Pin 1	Header 1 pos'n	3513 504 00121	
	Header less ears 10 pos'n	FP99220	
LK1,2	Header str male 3 pos'n	FC00837/03	
PLC	Header str male 7 pos'n	FC00837/07	
	Header str male 10 pos'n	FC00837/10	
	Link connector	FC99060	
	Plug 25-way D-type angle	FP99027	
LK3	Plug PCB mtd 2 X 8	FP99182	
	Nut st hex M2,5	QA11604/B	2/25-way plug
	Nut st hex M3	QA11605/X	1/IC1
	Bush insulating (TO-220)	QA99024	1/IC1
	Washer thermal (TO-220)	QA99111	1/IC1
	Scr st pan pozi M3 x 6mm	QJ11901/X	1/IC1
	Scr st pan pozi M2,5 x 10mm	QJ11947/B	2/25-way plug